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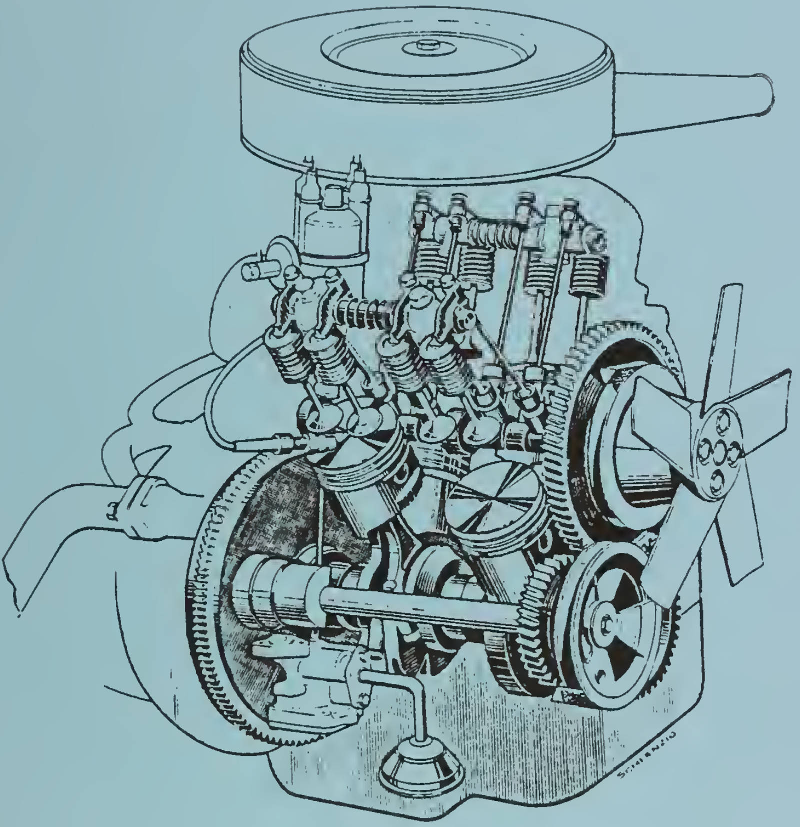

INDUSTRIAL EDUCATION

1984

Curriculum

Alberta
EDUCATION

ACKNOWLEDGMENTS

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NOTE: This publication is a service document. The advice and direction offered is suggestive except where it duplicates or paraphrases the contents of the Program of Studies. In these instances, the content is in the same distinctive manner as this notice so that the reader may readily identify all prescriptive statements or segments of the document.

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INDUSTRIAL EDUCATION

RATIONALE

Industrial Education is a program consisting of courses which provide a continuum of experiences, starting with exploratory activities in the junior high school and expanding in the high school to the development of skills related to career fields. This development of the student's skills is planned for through courses in industrial and vocational education culminating in on-the-job work experience, or entry into a job or post-high school institution for further education.

The program consists of courses ranging from those designed for an exploration of the technologies and trade areas to units of practical preparation for a career. In the process the courses develop the student's self-knowledge, talents and skills.

For information on sequencing and course description, refer to the "Industrial Education Manual for Guidance to Teachers, Counsellors and Administrators".

PROGRAMS

There are two parts to the Industrial Education program. The first part consists of the I.E. 10, 20, 30 series of courses and is designed for career orientation. These courses were developed primarily for students in laboratories that utilize the multiple activity approach as found in most smaller schools, but they can be taught in unit shops as well.

The second part consists of the I.E. 12, 22, 32 series of courses and is intended for career development. The courses are planned for use in schools where facilities are available to teach specific occupational areas.

Students may progress from the I.E. 10, 20, 30 series to the 22 level courses upon meeting specified basic prerequisites or upon recommendation of their principal.

Both sections of the program focus on six career fields. These are:

Graphic Communications
Mechanics
Construction and Fabrication
Electricity-Electronics
Personal Services
Horticulture

The I.E. 10, 20, 30 courses consist of a number of 25-hour modules related to the career fields while the I.E. 12, 22, 32 courses consist of a number of 25-hour modules of specific occupational content. Completion of seven five credit modules qualifies the student for recognition by the Apprenticeship Branch for credit towards a journeyman's certificate.

Two modules taught for a total of 65 hours will serve as a prerequisite for the appropriate 22 level course. It is left to the administrators of the school to offer the courses or combination of courses best suited to the needs and interests of the students and the financial resources of the district.

Courses offered at the 22 and 32 level have to meet special criteria for staff and facilities. The Industrial Education Consultant must authorize these in order to qualify the students for vocational grants.

OBJECTIVES OF INDUSTRIAL EDUCATION

The Industrial Education Program can help achieve the Goals of Schooling and Education. The course objectives are more focused and give direction to the teacher.

The objectives of Industrial Education are classified in three areas with the following purposes:

A. Personal Growth:

To provide opportunities for the individual growth of the student through the development of acceptable personal and social values necessary in a productive society.

1. To provide a technical environment which motivates and stimulates individuals to discover their interests and develop personal and social responsibilities.
2. To assist in the development of positive attitudes toward safety.
3. To assist in the development of positive attitudes toward conservation and environment.
4. To assist in the development of consumer literacy.

B. Career Exploration:

To provide students with experiences which will assist him or her in making realistic career choices.

1. To provide students an opportunity, within a technical environment to become acquainted with the general occupational characteristics of a variety of career fields.
2. To relate their own interests, abilities, likes, dislikes and values to serveral career fields.

C. Occupational Skills:

To develop basic competencies, integrating cognitive and psychomotor skills related to families of occupations.

1. To provide safe exploratory experiences in the use of tools, energy, equipment and materials appropriate to various technologies prevalent in a productive society.
2. To develop an understanding of the interrelationships of various technologies.
3. To provide a technical environment which permits students to synthesize their accumulated knowledge in the solution of practical problems, and to assist students to develop habits that will be conducive to the establishment of a safe environment.

INDUSTRIAL EDUCATION 12, 22, 32 PROGRAM

INTRODUCTION

The Industrial Education 12, 22, 32 program is a series of courses which develop competencies leading to six different career fields.

Entry into a career field may be gained by taking one of several related introductory courses. These are:

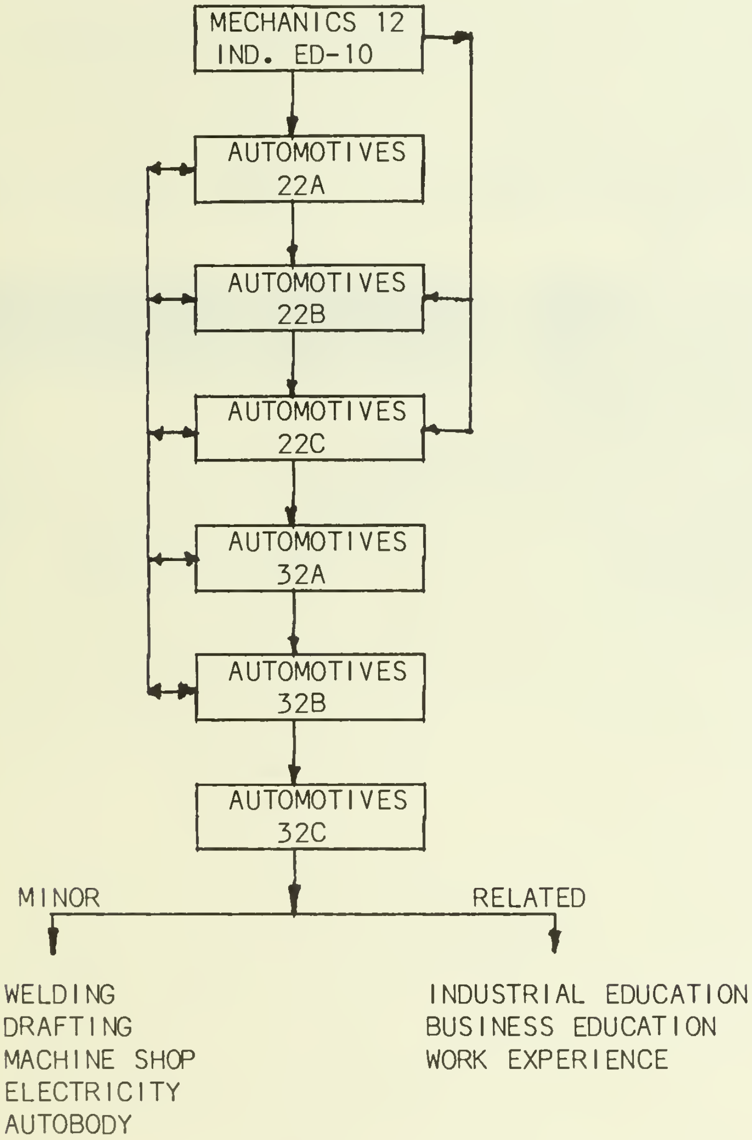
1. the "12" course designated for each major, or
2. two modules from the Industrial Education "10, 20, 30" series related to the anticipated major, or
3. one half of a "12" course. The other half would be another half "12" or a module from the "10" program. The course would be recorded as Industrial Education "10".

Following the introductory course the student may advance to the major area of study by selecting any number of five credit modules from the courses designated as "22" or "32". The scheduling and sequencing of the modules is the responsibility of the local school personnel but must be in accordance with the regulations pertaining to prerequisites.

A student registered in a second or third level course ("22" or "32") is regarded as taking a major in that course area. Having established a major the student may select courses designated as minors and in this way broaden his/her practical skill base in a career field or even several career fields. However, students must complete all the preceding modules in a major series (usually six) before taking the 32C module (exception: Beauty Culture).

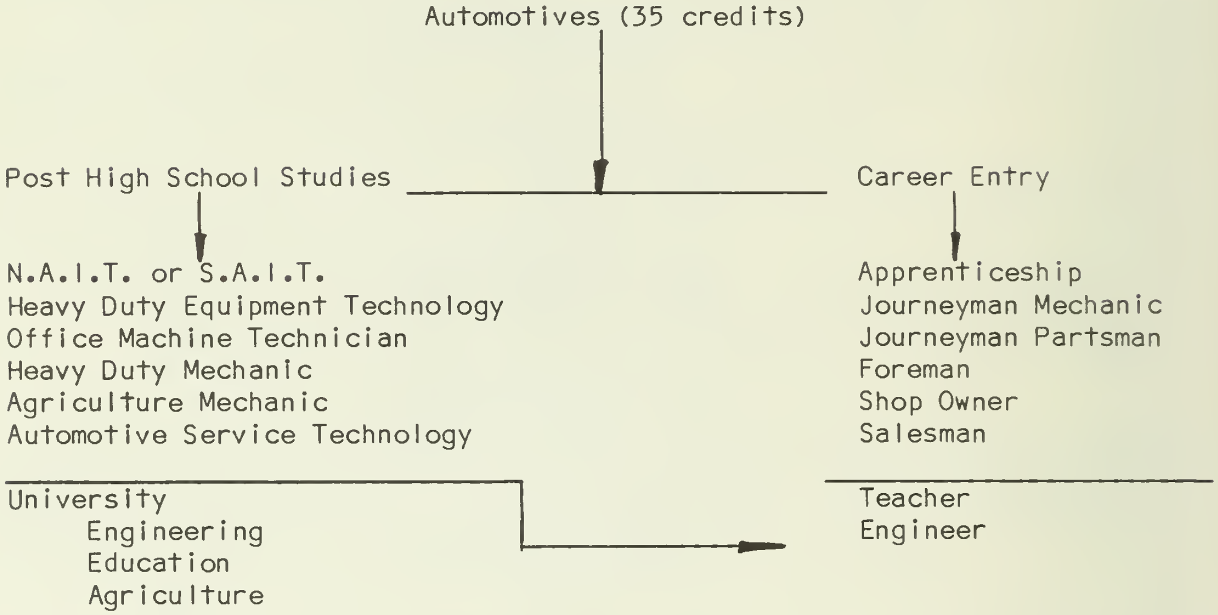
CAREER FIELD

AUTOMOTIVES



CAREER OPPORTUNITIES

Students having taken all or most of the modules in the Automotives major may look forward to the following career areas:



Automotives (35 credits)

Post High School Studies

N.A.I.T. or S.A.I.T.
Heavy Duty Equipment Technology
Office Machine Technician
Heavy Duty Mechanic
Agriculture Mechanic
Automotive Service Technology

University
    Engineering
    Education
    Agriculture

Career Entry

Apprenticeship
Journeyman Mechanic
Journeyman Partsman
Foreman
Shop Owner
Salesman

Teacher
Engineer

MECHANICS 12

COURSE CONTENT
MECHANICS 12 (5 CREDITS)

INTRODUCTION

Mechanics 12 is an introductory course leading to all the major areas in the career field of mechanics. Students are introduced to power sources and methods of transmission. The student studies the construction and operation of machines, particularly the motor vehicle, and engages in the activities of testing, disassembly and assembly of machines, reading, researching and applying information learned to analysing and repairing minor machine problems.

OBJECTIVES

The specific objectives of the Mechanics 12 course are:

1. To enable the student to understand the use, care and control of the power machine.
2. To allow the student to gain an insight into the construction and operation of machines which convert energy to useful work.
3. To provide the student with realistic experiences so that he/she is better able to make a career choice based on accurate information.
4. To help the student understand the many basic laws and principles of science at work in mechanics, and relate these laws and principles to the vast area of power technology.

LEARNING RESOURCES

Stockel, M.W. Auto Mechanics Fundamentals Goodheart-Willcox Co. Inc., Latest Edition.
Beeler, Sam C. Understanding Your Car McKnight and McKnight, 1967
*Crouse, W.H. Automotive Mechanics McGraw-Hill Ryerson. SI Edition, 1980
Hill, H.G. Interpreting Automotive Systems Delmar, 1977
Nash, F.C. Automotive Fundamentals McGraw-Hill, 1977
Nash, F.C. Automotive Technology McGraw-Hill, 1979
Scott, E.F. and Toby, B. The Car Longman Group Ltd., 1978
Stahn, C.R. Automobile Construction and Operation
Steckner, T. Automotive Mechanics and Technology Gage Publishing Ltd.
*Thiessen, F. and Dales, Davis Automotive Principles and Service Prentice Hall, 1981
Time Life, The Time Life Book of the Family Car Time Lifebooks
Films. Shell Oil Company of Canada
Filmstrip - Moreland Latchford

Service Manuals, Booklets, Charts, Films, Filmstrips etc. from General Motors, Ford and Chrysler Companies.
Look First at the Retail Automobile Business G.M. pamphlet
Your Future in the Automotive Industry Dawson Taylor; Richard Rosens Press
Find a Career in Auto Mechanics C.W. Harrison; Putman
Toboldt, W.K. Diesel Fundamentals, Service and Repair Goodheart, Willcox Inc.

*Refers to prescribed learning resources.

CONTENT SUMMARY:

1. Career field study
2. Safety
3. Shop Practices
4. Automobile Care and Ownership
5. Power Sources
6. Engine Support Systems
7. Transmission of Power

TOPIC 1: CAREER FIELD STUDY VAM12

GENERALIZATION: There are many occupations within and related to the field of Mechanics.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Career Field Occupations	- make a survey of the various occupations available in the career field and list the entry requirements - list courses in his/her school system that lead to his/her career choice.		
2. Employment Opportunities: - local - regional - national	- discuss employment opportunities in the mechanics career field		
3. Trade Certification	- explain journeyman certification requirements and articulation with the Apprenticeship Branch - explain automotive training possibilities at institutes and colleges		

NOTES:

GENERALIZATION: A knowledge and practice of safety is essential in all lab. or shop activities.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Safe operation of tools and equipment	- operate safely tools and equipment such as: - hoists - jacking devices and stands - compressed air and equipment - hand tools - power equipment - welding equipment - lifting equipment - other equipment		
2. Unsafe acts and Conditions	- identify unsafe acts and conditions which could lead to injuries		
3. Accident Reporting	- explain purpose and use of accident report forms and report all accidents.		
4. Compensation	- explain the function of and benefits available under the Workers' Compensation Act		
5. First Aid	- attend to all minor injuries		
6. Safety Program	- participate in the prescribed safety program of the lab and/or school system		

NOTES:

GENERALIZATION: A knowledge of efficient shop practice includes the care and use of tools and equipment, fasteners, and the proper use of repair manuals and other information sources.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Hand Tools	- demonstrate correct use of basic hand tools such as: - wrenches - hammers - screwdrivers - chisels and punches - reamers - flaring tools - drills - taps and dies - stud and bolt removers - other		
2. Measuring Instruments	- demonstrate correct use of measuring tools such as: - feeler gauges - steel scales or rulers - micrometers - dial indicators - telescoping gauges - small hole gauges - other		
3. Fasteners	- correctly identify and describe application of fasteners such as: - bolts, screws and studs - thread designations - tensile strength - head and thread sizes - thread repair procedures - setscrews and keys - snaprings - pins - washers - chemical - other		

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
4. Specialized Equipment	As the need arises, the student will be given instruction and demonstration in the proper use of any tools or equipment necessary to complete tasks outlined in the curriculum or developed by individual teachers. Included may be tools such as: - battery hydrometer - anti-freeze tester - fan belt tension gauge - other		
5. Repair Manuals and Specifications	Given instruction the student will: - be able to select the correct manual and the applicable section - become familiar with the process of reading and using a repair manual and specifications		

NOTES:

TOPIC 4: AUTOMOBILE CARE AND OWNERSHIP

GENERALIZATION: Scheduled maintenance and inspection is important to the efficient operation of a unit.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		

1. Body Maintenance	- wash and clean a vehicle
	  - interior and exterior
	- polish a vehicle
	- remove stains such as:
	  - grease and oil
	  - blood
	  - lipstick
	  - etc.		

2. Chassis inspection and maintenance	- identify and locate lubrication reservoirs
	- explain how moving parts receive lubrication
	- lubricate a vehicle using correct oils and greases
	- check fluid levels
	  - radiator; including anti-freeze strength
	  - engine crankcase
	  - transmission and (transfer case)
	  - axle(s)
	  - windshield washer fluid
	  - brake (and clutch) reservoirs
	  - etc.		

NOTES:

TOPIC 4: AUTOMOBILE CARE AND OWNERSHIP (continued) VAM12

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- Inspection and Maintenance	- make checks of - battery connections - oil and coolant leaks - tire condition and pressures - lights and horn - air cleaner - windshield wipers - fan and other belts - hose condition - etc.		
	- perform minor repairs and adjustments such as: - tire repair - belt replacement - filter(s) replacement - wiper blade replacement - etc.		
3. Insurance (optional)	- read an insurance policy and list the coverage on: - property damage - injury liability - collision and upset - comprehensive - medical payments - etc.		
	- calculate the cost of insurance considering age and locality		
4. Vehicle Purchasing (optional)	- evaluate the advantages and disadvantages of buying a new or used vehicle		
	- devise a check list for use when buying a new or used vehicle		
	- note ways of having vehicles inspected prior to purchase		

NOTES:

TOPIC 5: POWER SOURCES VAM12

GENERALIZATION: Engines are fundamental to modern industrial society.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Types			
- External	- analyse the operating fundamentals of an external combustion engine - e.g. steam engine		
- Internal	- analyse the operating fundamentals of the internal combustion engine e.g., - piston engine (2 and 4 stroke) - rotary - turbine Note: General fundamentals and comparisons only - detailed study of the piston engine follows.		
2. Methods of piston engine classification	- analyse the various piston engines under headings such as: - design - cooling methods - stroke cycle - head design - valve arrangement - induction methods - cylinder arrangement - type of fuel - etc.		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
3. Piston Engine terms	- study the meanings and methods of calculating the following where applicable: - bore - stroke - throw - clearance volume - piston displacement - total volume - compression ratio - torque - horsepower - etc.		
4. Engine Construction and Operation	- The intent of this learning task(s) is to have the student correctly disassemble, inspect, measure and reassemble correctly an engine. Repair procedures other than replacing broken or missing parts or repairing damaged threads are not included in this general overview course. - use a shop unit(s) and reference material to study the construction, operation, parts, function, measurements and installation procedures of the following components (where applicable): - engine block - pistons and rings - connecting rods - crankshaft - camshaft - valve train - cylinder head - bearings, seals and gaskets		

NOTES:

GENERALIZATION: Engines require support systems for continuous operation.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Fuel System			
- Types of Fuel	- recognize the various fuel types such as: - gasoline - diesel - LPG		
- Fuel Pump	- list the parts - explain its operation		
- Carburetor	- explain the function in a general way - list the major parts - explain the difference between various types such as: - single, two, and four barrel - updraft, downdraft and sidedraft - adjust a carburetor idle mixture and speed - adjust the automatic choke (if equipped) - discuss methods of increasing gas mileage: - driving habits - tire pressures - etc.		
- Fuel Injection	- discuss: - gasoline - diesel		

NOTES:

TOPIC 6: ENGINE SUPPORT SYSTEMS (continued) VAM12

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES

2. Exhaust System	- explain the dangers of a leak in the exhaust system
	- check the condition of:
	  - exhaust pipe
	  - muffler and/or resonator
	  - tail pipe(s)
	  - catalytic convertor		

3. Cooling System	- explain the need for a cooling system - list the parts and their functions - discuss the uses and types of anti-freeze solutions - examine an air cooled engine design		
4. Lubrication System			
- Oil pump	- list the parts - explain its operation		
- Filtering System	- explain its function - discuss full flow and partial flow systems		

- Oil	- classify oils used
	  - viscosity
	  - service ratings		

- Crankcase Ventilation	- identify the parts and functions - perform minor service - e.g. PCV valve		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
5. Electrical System			
- Battery	- identify the parts and materials - test the battery - prepare it for charging and charge it - identify "maintenance free" battery - clean battery and connections - observe safety around a battery		
- Alternator or Generator	- discuss its function - locate it on the vehicle		
- Charging Controls	- describe the functions of various controls in a general way - locate on the vehicle		
- Starter	- discuss its function and operation - locate it on the vehicle		
- Ignition System	- list the parts - describe the function and operation in a general way - locate the parts on a vehicle		

NOTES:

TOPIC 7: TRANSMISSION OF POWER

GENERALIZATION: The transmission of power can be accomplished through fluid or mechanical means.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Hydraulic Systems			
- Brakes	- list the parts - describe the operation - relate to each other: - force, pressure, area and relative movement - disassemble and assemble the following units following approved procedures: - master cylinder - wheel cylinder - wheel assemblies - drum type - disc type - parking brakes		
2. Mechanical Systems			
- Power Train			
- Clutch	- identify clutch parts - explain clutch operation		
- Transmission	- list the parts - discuss gear types and calculate ratios - explain path of power - explain synchromesh - explain detent and interlock - disassemble and assemble a transmission using correct procedures		
- Drive Line	- identify parts - explain operation		

AUTOMOTIVES 22A

COURSE CONTENT
AUTOMOTIVES 22A (5 CREDITS)

INTRODUCTION

Automotives 22A may be selected after completion of Mechanics 12 or Industrial Education 10.

The control of an automobile is dependent on the running gear and all its components. This module of study provides an introduction to brakes, steering and suspension.

OBJECTIVES

The objectives of the Automotives 22A module are:

1. To expose the student by direct involvement and reference book description, to those components of the automobile that are concerned with control characteristics such as steering, suspension and braking;
2. To let the student employ measuring and correction tools, and manufacturers' recommendations and specifications to assist in the diagnosis and elimination of problems;
3. To make the student constantly practice safety procedures while working with machines;
4. To demand of the student absolute cleanliness in the maintenance of the automobile parts, tools and facilities;
5. To leave the student with a sense of achievement and pride that will motivate self-improvement in the skills of diagnosis and correction of problems in automobile maintenance.

LEARNING RESOURCES

Stockel, Auto Service and Repair Goodheart-Willcox Co., Latest Ed.
Crouse, W.H., Automotive Mechanics S.I. Ed., McGraw-Hill Ryerson, 1980
Nash, F.C., Automotive Technology McGraw-Hill Ryerson, 1978
*Thiessen, F. and Dales, Davis, Automotive Principles and Service Prentice Hall, 1981
Remling, John, Brakes John Wiley and Sons, Toronto.
Remling, John, Steering and Suspension John Wiley and Sons, Toronto.

*Refers to prescribed learning resource.

CONTENT SUMMARY

1. Suspension
   - stability and control
   - wheel and tire assembly
   - steering gear

2. Steering geometry
   - alignment
   - problem diagnosis

3. Brakes
   - types
   - power assist brakes
   - brake principle
   - maintenance and repair

GENERALIZATION: Stability and directional control are important factors in handling a vehicle. The suspension system forms the framework upon which stability and control are built.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Stability and Control - Support Structure	- identify: - separate steel frames - integral body and frame		
- Suspension	- examine and identify front and rear suspension systems such as those equipped with "I" beam axles, coil spring, leaf spring, air or torsion bar-equipped independent front and rear suspensions		
	- examine, identify and repair components in the suspension systems - leaf spring - coil spring - torsion bars - air - MacPherson Strut - shock absorbers - sway eliminators - wheels and tires		
- Unsprung Weight/Sprung Weight	- define both sprung weight and unsprung weight and name all the parts so affected		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- Torque Control	- identify and describe methods of controlling rear end torque in vehicles equipped with: - torque tube drive - Hotchkiss drive		
2. Wheel and Tire Assembly	- perform the following checks and corrections: - inflation - run-out - balance (static and dynamic)		
	- examine tire types and draw diagrams to illustrate arrangement of materials in the tire, as well as the tread design		
3. Steering Gear	- identify the various parts and relate the operation of these parts to control of the vehicle		
	- disassemble, assemble and make adjustments such as: - bearing pre-load - end play - high point or through center - etc.		
- Power Steering Pump	- name the parts - correctly disassemble, repair and assemble		
- Steering Linkage	- inspect and replace: - ball joints - tie rod ends - idler arm - other		
- Shock Absorbers	- describe: - the action of shock absorbers - the location - the method of attachment - how to check - replace shock absorbers		

TOPIC 2: STEERING GEOMETRY VAM22A

GENERALIZATION: Correct steering geometry is necessary for vehicle stability and control.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Alignment	- measure and adjust: - caster - camber - toe-in - toe-out on turns - steering axis inclination - included angle - curb height - tracking - wheel run-out - steering wheel centering		
2. Problem Diagnosis	- identify and correct causes of: - tire wear - hard steering - pulling to one side - vibration or wheel shimmy - noise - wheel bounce - loose steering		

NOTES:

TOPIC 3: BRAKES

GENERALIZATION: The brake system is essential to the stability and control of the vehicle.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		

1. Brake Types	- identify parts
	- explain operation
	- correctly disassemble and assemble components
	  - drum brakes
	  - disc brakes
	  - parking brakes		

2. Power Assist Brakes	- identify vacuum suspended and atmospheric suspended power brakes		

3. Brake Principle	- given information and instruction:
	  - solve problems using force, pressure and area
	  - define the terms
	  - calculate brake shoe force given piston areas, pressures and/or pedal force and leverage.		

4. Maintenance and Repair	- diagnose problems such as:
	  - no pedal
	  - low pedal
	  - hard pedal
	  - vehicle pulls to one side
	  - noise
	  - brake drag
	- inspect brake systems for:
	  - lining wear
	  - pad wear
	  - hydraulic leaks
	  - etc.		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES

	- repair brake systems
	  - overhaul power brakes
	  - overhaul master cylinder
	  - replace linings and/or shoes
	  - replace pads
	  - machine drums and discs
	  - replace hoses and lines
	  - overhaul wheel cylinders
	  - replace parking brake cables
	  - check operation of valves such as:
	    - metering valves
	    - proportioning valve
	  - check warning system
	  - bleed the system
	  - etc.		

NOTES:

AUTOMOTIVES 22B

COURSE CONTENT
AUTOMOTIVES 22B (5 CREDITS)

INTRODUCTION

Automotives 22B may be selected after completion of Mechanics 12 or Industrial Education 10.

OBJECTIVES

The objectives of the Automotives 22B module are:

1. To develop in the student the attitudes and skills required of a motor mechanic;
2. To familiarize the student with automotive power trains and thus relate theoretical background to that of repair;
3. To develop in the student the habits of critical thinking in the analysis of power train problems;
4. To acquaint the student with manufacturers' manuals and a variety of technical publications and to acquire practice in their use;
5. To provide the student with a basis for further study into power trains.

LEARNING RESOURCES

Stockel, Auto Service and Repair Goodheart-Willcox Co, Latest Ed.
Crouse, W.H., Automotive Mechanics S.I. Ed., McGraw-Hill Ryerson, 1980
Nash, F.C., Automotive Technology McGraw-Hill Ryerson, 1978
*Thiessen, F. and Dales, Davis, Automotive Principles and Service Prentice Hall, 1981

*Refers to prescribed learning resource.

CONTENT SUMMARY

1. Power train components and service
   - clutch
   - transmissions
   - drive lines and universal joints
   - rear axle assembly
   - principles of differential gear adjustments
   - disassembly, inspection and assembly of differential
   - trans axles
   - axles
   - independent rear suspension

TOPIC 1: POWER TRAIN COMPONENTS AND SERVICE
CLUTCH, TRANSMISSION, DRIVE LINE AND REAR AXLE.

GENERALIZATION: The function of the power train is to provide a flexible and variable means of transferring torque to propel the vehicle.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Clutch			
- Functions	- identify all parts and describe their function		
- Path of Power	- trace and record the path of power from engine to transmission		
- Engagement/ release - mechanical - hydraulic	- indicate the direction of lever action when the clutch is engaged or released.		
- Construction - Operation	- diagnose: - clutch slippage - clutch chatter or grab - poor clutch release - clutch noise when pedal depressed - clutch noise when pedal released - transmission shift problems due to clutch - other problems		
- Inspection	- given parts of the clutch which are not acceptable, give probable causes of failure		
- Pilot bearing	- locate the pilot bearing and describe its function		
- Service	- remove and replace the pilot bearing/bushing		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- perform the following checks and record specifications (tolerance): - alignment of clutch housing to crankshaft center line (bore run-out) - transmission attaching surface must be true (clutch housing run-out) - flywheel run-out		
	- disassemble a clutch assembly, identify parts, identify parts for replacement, re-assemble and adjust a clutch to provide satisfactory operation		
2. The Transmission - Manual synchromesh	- identify each part in a transmission and label the same on a prepared diagram. A detailed labelling of every part is necessary		
	- given gear combinations, calculate: - mechanical advantage (torque) - speed ratio		
	- given gear combinations arrange these gears schematically to obtain a change in direction of rotation.		
	- given gear combinations with the number of gear teeth specified, arrange these gears to obtain changes in direction or rotation and calculate: - torque (M.A.) - speed ratio		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- given gears with the number of teeth specified, arrange the gears to obtain a torque multiplication and retain the direction of rotation of the initial gear		
- Gear ratios	- trace the power flow through the transmission in: - low - second - third - fourth - fifth - overdrive - reverse		
- Gear Clash - Synchronization	- identify the parts and describe their operation in a synchromesh unit		
- Detent and interlock	- explain the function and operation of a transmission detent and interlock system		
- Helical gears	- study the angle of teeth in each of the gears in mesh and determine the direction of thrust. From these observations, explain the locations of all thrust washers within the transmission		
	- upon observing the relative location and angle of the helical gears, explain the presence or absence of thrust washers		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- Lubrication	- identify the oil passages of the clutch shaft and transmission housing that lubricate the: - needle bearings - front bearings - rear bearings - gears and shafts		
	- locate the oil filler plug and observe the relative position of the counter-shaft to the filler plug		
- Transmission - Diagnosis	- given one or more of the following hypothetical problems, itemize possible corrections: - hard shifting - gear clash during downshift - noisy in neutral engine running - noisy only in one of the gears - other problems		
- Transmission overhaul	- given the three speed transmission and a corresponding shop manual, disassemble the transmission according to the procedures outlined in the shop manual		
	- make all necessary checks and compare these to manufacturer's specifications		
	- given a disassembled transmission and corresponding manual, assemble according to the procedures outlined in the manual		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- Front wheel drive	- using appropriate shop manuals or actual unit check the trans axle for disassembly and assembly from the rest of the unit - gear ratios - shifting linkage positions - gear designs, bearings and seals as used in other transmissions - compare this transmission to a conventional standard transmission; note differences and similarities		
- Automatic Transmissions			
- Construction	- identify the components		
- Torque Convertor	- trace the flow of fluid in the torque convertor		
- Planetary gears	- trace flow of power through gear sets		
- Hydraulic Components	- explain the operation and location of each unit and its location in the transmission - bands - clutches - pumps - valves - servos - governors		
- Service	- perform a minor service job on a transmission		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
3. Drive Lines and Universal Joints			
- Torque tube drive	- determine how the driving force is transmitted from the axle housing to the frame		
- Universal joints	- explain the speed fluctuations and control in universal joints		
- Constant velocity universal joint	- trace the torque through the assemblies at different angles and note how cycling or speed fluctuation is reduced		
- Protection	- identify the devices used to protect the universal joint		
- Slip joint	- identify the slip joint and describe its operation		
- Servicing	- remove and replace the universal joint		
- The propeller shaft	- perform all checks such as: outlined in the shop manual for propeller shaft service (angle, balance, length)		
4. Rear Axle Assembly			
- Torque transfer at different speeds	- identify the parts		
- The crown gear and pinion complex	- identify a hypoid gear and discuss its advantages and disadvantages compared with the bevel and spiral bevel designs		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- Pinion to gear ratios	- given a differential assembly count the number of teeth in the drive pinion and the number of teeth in the crown gear and calculate the mechanical advantage and gear ratio		
- The differential case	- hold one axle gear and observe the differential pinion gears rotate on the differential pinion pin and "walk" around the stationary axle gear		
	- observe, record and compare the number of revolutions made by the case to the number of revolutions of the axle gear that is in motion while one gear is held		
- Torque equality	- given a differential with axle stubs turn the differential case under two conditions - with equal resistance at both axles - with resistance only at one wheel		
	- describe the action within the differential case and note the stress between axle gears and differential pinion gears		
- Pinion gear supports	- record a part to part transfer of power from the drive pinion to the axles		
	- compare a straddle mount and overhanging mount pinion, for strength, accessibility and method of pinion depth adjustment		

TOPIC 1: POWER TRAIN COMPONENTS AND SERVICE CLUTCH, TRANSMISSION, DRIVE LINE AND REAR AXLE. (continued) VAM22B

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
5. Principles of Differential Gear Adjustment			
- Pinion bearings preload	- given a pinion with an adjustable crust sleeve, perform a bearing preload adjustment according to the procedures outlined in a shop manual - identify one other method of adjusting the pinion bearing preload (shims)		
- Pinion position	- discuss the relationship of the pinion marks to the carrier measurement and the methods of adjustment		
- Differential side bearing preload	- given a differential assembly, practise a side bearing adjustment according to the procedures outlined in the shop manual		
- Backlash	- given a differential assembly, practise changing the backlash without disturbing the side bearing preload; this procedure will be clearly outlined in the shop manual		
6. Disassembly, Inspection and Assembly			
- Preliminary checking	- given a differential assembly, disassemble and study each part in the sequence of power-flow, noting the points of possible wear		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- given a disassembled carrier, trace the oil flow to the bearings		
	- assemble the differential and make all necessary checks and adjustments. Each check and adjustment will be recorded		
- Checking by a pattern	- given the differential assembly, "paint" the teeth and interpret the resulting pattern and make corrections where necessary		
- Problem diagnosis	- given the following problems, give possible causes and repairs: - noise under load in straight ahead motion - noise when making a turn - a "clunk" when powerflow is interrupted - loss of lubricant - overheating in the pinion bearing area		
- "Non-slip" differential	- given shop manuals or several makes and models of vehicles equipped with a "traction differential", compare the differentials under the following criteria: - location of differential clutches - types of clutches (cone or disc) - method of testing the efficiency - principle of operation		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
7. Trans axles	- note the power flow through the differential - compare trans axles to conventional differentials - note differences and similarities to a conventional differential - note advantages and disadvantages to a conventional differential - note how trans axle differential is held in position and how it is supported		
8. Axles			
- Drive axle shafts	- given diagram or models of semi-floating and full-floating rear axle assemblies correctly identify all parts and describe their operation		
- Semi-floating rear axle	- determine the method used to retain the axle in the housing		
- Full-floating axle	- discuss the strength and application of the two types of rear axles: - semi-floating - full-floating		
- Removal and replacement	- given a rear axle assembly complete with housing, remove axles from the differential according to procedures outlined in the shop manual - study the bearing and seal complex - where applicable, adjust axle and play and complete the axle installation as prescribed in the manual		

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
9. Independent rear suspension	- using the appropriate text books or live models, compare the open rear axle to a conventional differential in: - construction of axles to differential - advantages and disadvantages to this type of a system - lifting procedures on a twin post hoist		

NOTES:

AUTOMOTIVES 22C

COURSE CONTENT
AUTOMOTIVES 22C (5 CREDITS)

INTRODUCTION

The Automotives 22C module may be taken at any time following completion of Mechanics 12 or Industrial Education 10.

OBJECTIVES

The objectives of the Automotives 22C module are:

1. To provide the student with experiences which will relate previously mastered theories to modern mechanical developments;
2. To provide the student with experiences which will provide a basis for further research in the development of the automotive electrical systems;
3. To provide the student with experiences which can be related to other mechanics and electrical fields.

LEARNING RESOURCES

Stockel, Auto Service and Repair Goodheart-Willcox Co, Latest Ed.
Crouse, W.H., Automotive Mechanics S.I. Ed., McGraw-Hill Ryerson, 1980
Nash, F.C., Automotive Technology McGraw-Hill Ryerson, 1978
*Thiessen, F. and Dales, Davis, Automotive Principles and Service Prentice Hall, 1981

*Refers to prescribed learning resource.

CONTENT SUMMARY

1. Electricity and Magnetism
   - control of electrical power

2. Sources of Electrical Energy; Battery
   - cell composition
   - electro-chemical energy
   - testing
   - servicing

3. Sources of Electrical Energy; Generator/Alternator
   - component identification
   - "troubleshooting"
   - testing
   - the generator/alternator

4. Application of Electricity to the Automobile
   - starting system
   - ignition system
   - lights
   - junction blocks
   - electronic ignition
   - compression ignition
   - electrical accessories
   - color coding of electrical circuitry

5. Oxy-Acetylene Heating and Cutting
   - equipment
   - safety code and practice
   - equipment operation

TOPIC 1: ELECTRICITY AND MAGNETISM

GENERALIZATION: Electricity and magnetism are fundamental to the operation of the Automobile.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
1. Modern technology is dependent on the control of Electrical power	The student will: - analyze the electrical nature of matter in terms of: - the electron theory - static electricity - current electricity - electromotive force or potential - electrical power - capacitance (farad) - electrical circuits, simple series, parallel, series-parallel - explain the laws governing the magnetic effects of the electrical current in terms of: - magnetic fields - permeability - shielding - magnetic induction - solenoid action - transformer action - attraction-repulsion principle		

NOTES:

TOPIC 2: SOURCES OF ELECTRICAL ENERGY; BATTERY VAM22C

GENERALIZATION: The storage battery provides the automobile ignition system and the accessories with the electrical energy required provided it is charged and maintained properly.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Cell composition	- identify the components of the storage battery and their relationship to each other such as: - number of cells - arrangement of cells - number of plates in a cell - size of plates - types of separators - electrolyte - container		
2. Electro chemical energy	- describe battery operation with the following aspects in mind: - chemical reaction on discharge - chemical reaction during charge - effects of temperature - self-discharge - battery rating		
3. Testing	- use the appropriate test devices and perform the following tests: - check electrolyte level and adjust if required - check specific gravity and correct for temperature variation		

NOTES:

TOPIC 2: SOURCES OF ELECTRICAL ENERGY; BATTERY (continued) VAM22C

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- perform an open circuit voltage test - perform a high rate discharge test		
4. Servicing	- service the battery as required - compare the construction and design of the maintenance-free type with the traditional lead-acid type battery - report on service and testing procedures of the maintenance-free battery		

TOPIC 3: SOURCES OF ELECTRICAL ENERGY; GENERATOR/ALTERNATOR VAM22C

GENERALIZATION: The direct current generator and the alternator are devices that convert mechanical energy into electrical energy to supplement electricity derived from the storage battery.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Component Identification	- identify components in the direct current generator and the alternator - describe the similarities and the differences in the terms of: - field - conductor - induction - rectification - control		

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
2. "Trouble shooting"	- diagnose the generating circuit troubles for: - battery condition - generator output - circuit resistance - regulator control		
3. Testing	- clean the generator - test field coils and armature windings for: - open circuit - short circuit - unintentional ground - machine the commutator - undercut the mica - replace brushes - install end bearings - perform the motorizing test - polarize - install and test the generator and its control mechanism		
The Alternating Current Generator	- diagnose problems as with the direct current generator where similarities exist: - restore slip ring surface - replace brush sets - install end bearings - test diodes - test TVRS capacitors - install the alternator in the charging circuit and test output, maximum voltage and the indicator - test stator windings		

NOTES:

GENERALIZATION: The principles of electricity and magnetism are applied to the operation of various devices which make the automobile convenient, comfortable, and safe to operate.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. The starting system	- examine and describe the components and operation of the starting system. These may include: - starter motor - starter drives - starting motor switch - safety devices such as the neutral safety switch - use test equipment to diagnose troubles and correct them if they exist. The tests will include: - no load - stall torque - locked resistance - circuit resistance - solenoid current draw - drive test - ballast resistor by-pass		
2. The ignition system	- draw a diagram showing the primary and secondary circuits of the electrical ignition system - label all the components - explain the operation		

NOTES:

TOPIC 4: APPLICATION OF ELECTRICITY TO THE AUTOMOBILE (continued) VAM22C

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- describe the action that takes place in the ignition system while: - engine is at rest - engine is idling - at high RPM no load - at low RPM heavy load - at high RPM heavy load - disassemble distributor - clean the various parts and lubricate - test and correct bearing clearance - test automatic advance mechanism - test and replace if necessary vacuum advance mechanism - test condenser - install points and adjust gap and or dwell - test for dwell variation - clean and test rotor - clean and test cap - test spark plug wires - service spark plugs - service ballast resistor - service ballast resistor by-pass circuit - service ignition switch - diagnose ignition troubles and correct same: - engine fails to start - engine is hard to start - engine misses while running		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
3. Lights	- test the following: - test and aim headlights - ensure operation of the directional signal - emergency warning - cornering - back-up - park - stop - instrument - dome - glove compartment - radio - panel - trunk - underhood - visor mirror - ignition switch - door lock - high beam indicator - courtesy - and any other that the vehicle may have as standard or optional equipment		
4. Junction Blocks	- have the opportunity to: - disassemble, inspect and reassemble connectors - straighten prongs - ascertain that push type male-female connectors are tight and clean - make certain that wires and looms are held firmly and are not near such things as hot manifolds or moving objects such as fan, pulleys, belts		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
5. Electronic Ignition	- work with the following systems as required and by the availability of test equipment. Priorities will be set by phasing out of former systems and adoption of replacement systems - Chrysler Electronic Ignition - General Motors High Energy Ignition System - Ford Duraspark - Systems used by American Motors and International Harvester - Other systems as they evolve		
6. Compression Ignition	- inspect the construction of a diesel engine - explain how the fuel mixture is ignited in a diesel engine		
7. Electrical accessories	- identify, and if time permits, make a study of principles of operation and service of: - horn - windshield wiper - washer - defroster - defogger - radio and/or other like devices - clock - power equipment such as: windows, door locks, seat, roof, antenna		
8. Junction blocks	- locate - inspect - disassemble - clean - reassemble		
9. Color Coding of electrical circuitry	- follow circuits according to the code - read symbols as required		

TOPIC 5: OXY-ACETYLENE HEATING AND CUTTING VAM22C

GENERALIZATION: The oxy-acetylene equipment is very useful in the field of Automotives for heating, soldering, brazing, welding and in cutting ferrous metals.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will identify:		Linde, Liquid Air, Victor or other manufacturers' operating manuals
1. Equipment	- the oxygen and acetylene cylinders by: - size - shape - color		
	- the oxygen and acetylene hoses by: - color - size - thread at the fittings		Safety films as available
	- the regulators for: - cylinder pressure - static and working line pressure		Demonstrations by welding supplies company representative
	- the need for proper use of: - eye shields-goggles - gloves - aprons - boots - cuffless coveralls - inert-filled containers to catch burning materials		
2. Safety Code and Practice	- describe the properties of: - hydrocarbons such as: - acetylene, butane, propane - oxygen		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- discuss the dangers of: - pressure vessels - "empty" cylinders - inflammable gases - neglect in safety precautions regarding oil and oxygen		
	- discuss the hazards of flammable materials (fuel,oil, rags) in close proximity to matches, lighters, batteries		
3. Operation of Equipment	- set up the equipment - mount cylinders on the cart - attach the gauges - attach the hoses - attach the blowpipe - attach the cutting head		
	- open cylinder valves - light and balance the flame - adjust the flame to neutral, carburizing, oxidizing - shut off		
	- explain: - the care and handling of hoses - the draw limit of the acetylene cylinder - the safe position and location of equipment for storage - safely practise all of the above as required in heating, soldering, brazing, welding and cutting.		

NOTES:

AUTOMOTIVES 32A

COURSE CONTENT
AUTOMOTIVES 32A (5 CREDITS)

INTRODUCTION

Automotives 32A may be selected at any time after the student has completed Automotives 22A. The module introduces the student to fuels, test equipment, and the techniques used in tuning the engine.

OBJECTIVES

The objectives of the Automotives 32A module are:

1. To provide the student with a basis for further study into fuel and tune-up;
2. To demand of the student absolute cleanliness in the maintenance of automobile parts, tools, and facilities;
3. To leave the student with a sense of achievement and pride that will motivate self-improvement in the skills of diagnosis and correction of problems in automobile maintenance.

LEARNING RESOURCES

*Crouse, W.H., _Automotive Mechanics_ S.I. Ed. McGraw-Hill Ryerson, 1980
Stockel, M.W. _Auto Service and Repair_ Goodheart-Willcox Co.
Nash, F.C. _Automotive Technology_ McGraw-Hill Ryerson.
*Thiessen, F. and Dales, Davis, _Automotive Principles and Service_ Prentice Hall, 1981

*Refers to prescribed learning resource.

CONTENT SUMMARY

1. Fuel system
   - types of fuels
   - fuel system components

2. Tune-up
   - test equipment
   - operational sequence for tune-up
   - checking other systems of the automobile that relate to tune-up

3. Exhaust and Emission Control Systems

GENERALIZATION: The fuel system is necessary to provide energy for the engine.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Types of Fuels - Gasoline - Diesel fuel - Liquefied petroleum gas	- given the information explain the characteristics of each of the fuels in terms of the following as they apply: - volatility - flame propagation - octane rating - detonation - preignition - cetane rating - energy content		
2. Fuel System Components			
- Fuel tank or reservoir	- examine, compare and contrast the method of storage of fuels for engines		
- Fuel lines and fuel filters	- examine conductors of fuel and filters noting design and location		
- Fuel pump	- describe the operation of pumps used to transfer fuel into the reservoir, carburetor or into the engine. - service the pumps		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- Carburetors	- make systematic diagnosis of troubles and make corrections common to each circuit - disassemble, clean and install a rebuilding kit, make necessary adjustments, check its operation on a live engine		
- The intake manifold	- describe the operation of the intake manifold as used on various engines - crossover pipe passages - equal length air flow - heat dams (shields)		
- Fuel gauges	- examine, describe the operation and test: - gasoline and diesel gauges - LPG gauges		
- Carburetor for gasoline	- given the information on a variety of current carburetors describe the construction and operating principles		
- Method of delivery of fuel into the combustion chamber	- describe the function and operation of venturis - describe the purpose and operation of each circuit commonly found on carburetors		
- Carburetor accessories	- examine, identify and explain the function, operating principle and service of: - fast idle cam - choke kick - choke unloader - thermostatic controls - anti-percolating device - anti-dieseling device - kick-down actuating device - vacuum outlets - heat shields or baffles		

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- Systems other than carburetors for fuel delivery into the engine	- given the information, examine the electronic fuel injection system with regard to: - air induction - fuel delivery		
- Diesel fuel entry into the combustion chamber	- examine, explain the construction and service of: - Diesel combustion chamber design - energy cells - heat glow plugs - fuel injectors - high pressure fuel delivery pumps - high pressure fuel lines - fuel filters - water traps - air filters		
- Diesel fuel system service	- given the information and diesel engines: - test low and high fuel pressures - distinguish between correct and incorrect injector spray patterns - bleed air from the system - time the high pressure pump - distinguish between normal and abnormal engine knocks - use engine test equipment and interpret readings: - compression gauges - pressure gauges - pyrometer		
- Liquefied Petroleum Gas	- examine and describe the principle of operation and service of: - reservoir - valves - gauges - filters - heating devices		

TOPIC 1: FUEL SYSTEM (continued) VAM32A

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- carburetor - fuel lines - safety features		
- Fuel economy	- describe the methods that manufacturers are employing in the achievement of better fuel economy. Some are: - smaller automobiles - smaller engines - lighter materials - manual transmissions - overdrives in both manual transmissions and automatic transmissions - lock-up torque convertors - LPG and Diesel fuels - other sources of energy such as electricity		

TOPIC 2: TUNE-UP VAM32A

GENERALIZATION: A tune-up is an important factor in achieving maximum performance, economical operation, and minimum harmful emissions.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Tune-up Test Equipment	- properly use the required test equipment: - electrical test devices - vacuum gauges and vacuum pump - pressure gauges - hydrometer - thermometer - pyrometer - infrared exhaust gas analyzer - idle enrichment device		

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
2. Operational sequence	- follow a sequence of operations such as the following: - test the battery - check cranking speed - check engine vacuum - compression pressure and/or cylinder leakage - check available ignition current and voltage - check fuel system - check exhaust gas restriction - check cooling system - check charging system - road test if possible		
3. Other systems of the automobile that relate to tune-up:			
- Engine mechanical condition	- describe an engine that is in good mechanical condition and perform tests for: - compression pressure - cylinder leakage - valve action		
- The electrical system	- test the various components of the electrical system: - battery - starting system - ignition system - distributor - primary and secondary wires - spark plugs - switches		
- The fuel system	- draw diagrams, describe components and circuits and test for proper operation		

TOPIC 2: TUNE-UP (continued) VAM32A

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- The cooling system	- test the various parts of the cooling system: - coolant protection - belt tension - thermostat action - indicator accuracy		
- The charging system	- use appropriate test devices and test procedures for: - maximum generator output - safe charging voltage		

TOPIC 3: EMISSION CONTROL SYSTEMS VAM32A

GENERALIZATION: The internal combustion engine is one of the major contributors to the pollution of the atmosphere.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Emission Control	- examine, discuss and service the various control systems: - positive crankcase ventilation - evaporation control systems - pressure-vacuum cap - charcoal canister - carburetor bowl vent - other carburetor controls - electric choke - thermostatic air cleaner - engine speed control during warm-up - altitude compensator - distributor controls		

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- vacuum advance - transmission control of spark for ignition - exhaust gas controls - exhaust gas recirculation - catalytic convertors - air injection systems - other		

NOTES:

AUTOMOTIVES 32B

COURSE CONTENT
AUTOMOTIVES 32B (5 CREDITS)

INTRODUCTION

The Automotives 32B module may be taken at any time following the completion of Automotives 22A.

OBJECTIVES

The objectives of the Automotives 32B module are:

1. To develop in the student some of the attitudes and skills required of a motor mechanic;
2. To familiarize the student with automotive engines, and thus relate his/her theoretical background to engine repair;
3. To develop in the students the habits of critical thinking in the analysis of engine problems;
4. To accustom the students to utilize manufacturers' manuals and a variety of technical publications;
5. To provide the student with a basis for further study into power systems at a more advanced level.

LEARNING RESOURCES

*Crouse, W., Automotive Mechanics S.I. Metric Ed. McGraw-Hill Ryerson, 1980
Stockel, M.W., Auto Service and Repair Goodheart-Willcox Co, Latest Ed.
*Thiessen, F. and Dales, Davis. Automotive Principles and Service Prentice Hall, 1981

*Refers to prescribed learning resources.

CONTENT SUMMARY

1. The internal combustion engine
   - construction and operation

2. The maintenance and repair of the internal combustion engine
   - disassembly procedure
   - engine assembly
   - tune-up
   - sequence of operations

3. Engine support systems
   - cooling
   - lubrication

TOPIC 1: THE INTERNAL COMBUSTION ENGINE VAM32B

GENERALIZATION: All internal combustion engines are basically similar in theory, design and maintenance.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Construction and Operation	- relate the concepts of the molecular theory of matter, atmospheric pressure and energy to: - valve motion - the four-stroke cycle - the factors affecting power output - the efficiency of the engine - engine horsepower		
	- investigate the relationship and function of the engine components - crankshaft and block assembly - camshaft and related parts - pistons and connecting rods		
	- investigate and compare a variety of engine designs, their construction and operation: - Vee versus in-line - overhead camshaft - air and liquid cooled - rotary and reciprocating		

NOTES:

TOPIC 2: THE MAINTENANCE AND REPAIR OF THE INTERNAL COMBUSTION ENGINE

VAM32B

GENERALIZATION: The internal combustion engine requires the adjustment or replacement of parts to maintain peak performance, economy, and minimum pollution.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Engine Disassembly	- disassemble an engine following the manufacturers recommendations		
- Parts	- analyse engine deposits		
- Cleaning - Inspection	- employ correct cleaning procedures of components		
- Measurement	- use measuring tools with care		
- Measuring devices	- analyse the variety of engine problems		
	- determine the size, fit and clearance of engine components		
2. Engine Assembly			
- Sub-assemblies - Lubrication - Safety factors	- employ a variety of testing devices to determine and isolate engine problems, and correct these problems		
3. Tune-Up - Electrical	- investigate the visual and mechanical tests required to tune an engine:		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- Fuel - Cooling - Mechanical	- battery and cables - cranking motor and circuit - engine mechanical condition - spark plugs - distributors and ignition circuit service - manifold and emission system service - carburetor and fuel system service - charging system - general vehicle inspection		
4. Sequence of Operations	- follow a sequence of operations in performing a tune-up. One such sequence is: - test battery - check spark plugs - check compression - check starting system - check fuel system - check ignition system - check charging system - road test if possible NOTE: Each part of the sequence can be enlarged on or the sequence can be modified slightly. Tests should be performed on a live engine.		

NOTES:

TOPIC 3: ENGINE SUPPORT SYSTEMS VAM32B

GENERALIZATION: For continuous operation the internal combustion engine depends on a number of support systems.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Cooling			
- Types	- using the appropriate text books and vehicles in the shop compare the two types of cooling systems, air and liquid		
- Parts	- outline the parts of the liquid and air cooling system. Compare and contrast the two systems.		
	- compare the two systems in monitoring a proper operating temperature and the method of dissipating surplus heat		
	- compare and contrast the anti-freeze used with iron and aluminium engines		
	- describe how the temperature indicators work on a liquid and air cooled system		
2. Lubrication			
- Oil - Properties	- using a text book describe the properties that a good lubricant must have: - viscosity - viscosity index - extreme pressure - service ratings		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- Lubricants	- using a suitable text compare and contrast the different types of lubricants		
-Deterioration -Types -Characteristics -Functions -Cooling -Cleaning	- compare the lubricants for viscosity, smell, etc. - describe different types of filters how they clean the lubricant and how much servicing is required - describe how the lubricant is cooled - describe how the crank case ventilation system works		
- Distribution	- describe the different methods of lubricant distribution: - pressure - splash - combination - drip system - immersion - describe how each system works and how the lubricating system is protected - oil pump - control mechanism - indicators		

NOTES:

AUTOMOTIVES 32C

COURSE CONTENT
AUTOMOTIVES 32C (5 CREDITS)

The last module of the Automotives sequence is open to students who have completed 30 credits or six modules in the major.

The 125 hours of instruction time available in this module may be used to:

(a) Provide greater depth to a module taken previously. Individual students, groups of students or whole classes may elect to study an area in more detail to develop more skills. This in-depth study could be in power systems, tune-up, or any of the modules named in the Automotives sequence.

OR

(b) Engage in actual garage work through a program coordinated by the Automotives teacher and under a journeyman mechanic on the job.

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